REMARKS

Present Status of the Claims

- Claims **1-55** are pending.
- Claims **33-55** are allowed.
- Claims **1-22** and **25-34** are rejected.
- Claims **23** and **24** are objected to.

Amendments to the Specification

The Specification was amended to update the "*Cross-Reference to Related Application*" by adding recently issued patent numbers and other updated patent application information (e.g., serial numbers, filing dates).

The Specification was also amended to correct a minor typographical error in a patent serial number.

Allowed Claims **35-55**

Applicants gratefully acknowledge the Office's allowance of claims **35-55**.

Objections to Claims **23** and **24**

The Office objected to claims **23** and **24** as being dependent on a rejected base claim, but indicated that they would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In response, applicants have rewritten claim **23** to be in independent form, including all of the limitations of base claim **1** and intervening claim **22**. Also, applicants have rewritten claim **24** to be in independent form, including all of the limitations of base claim **1**.

Accordingly, amended claims **23** and **24** are now in condition for allowance.

102(b) Rejections

Rejection of Claims **1, 5-11, 22,** and **25-34** under 35 U.S.C. § 102(b)

The Office rejected claims **1, 5-11, 22,** and **25-34** under 35 U.S.C. 102(b) as being anticipated by Rason et al. (US 3,843,896). Applicants respectfully disagree that *Rason* anticipates every limitation of claims **1, 5-11, 22,** and **25-34.**

Independent Claim 1

Claim **1** recites, inter alia, "*a collector electrode separated from said emitter electrode by a* ***micron-scale*** *interelectrode gap*". Applicant's specification (at p. 10, line 21) defines the phrase "*micron-spaced interelectrode gap*" to mean "*an interelectrode gap of preferably less than 10 microns, more preferably between approximately 1 micron and 10 microns, and most preferably between approximately 1 micron and 3 microns*". Having an interelectrode gap less than 10 microns allows the thermionic converter to be operated in the "unignited mode", which doesn't have the performance penalty due to space-charge effects that occur for gaps greater than 10 microns.

In contrast, *Rason* **does not teach** that the interelectrode gap is "micron-sized" or "micron-scaled". Instead, *Rason* teaches that the interelectrode gap, "**d**", is much greater than 10 microns, e.g., 170-250 microns (See *Rason*, Table D). Furthermore, *Rason* **teaches away** from operating his thermionic converter in the "unignited mode" when he states:

> *"Therefore, operation in the unignited mode is more efficient than in the ignited mode, since the plasma is maintained by thermal energy instead of electrical energy. However, it is readily shown that the* requirement for $\varphi_e \approx \varphi_c$ requires high emitter temperatures, excessively high cesium vapor pressures *and, therefore,* ***impractically small electrode spacings with known materials*** *for operation at high current densities."* [emphasis added] (See *Rason*, Col. 8, lines 28-35)

Hence, at the time that the application by *Rason* et al. was filed in 1972, persons of ordinary skill in the art did not know how, using materials known at that time, to reliably and cost-effectively manufacture thermionic converters with *micron-scale* interelectrode gaps (i.e., in the range of 1-10 microns).

Ten years later, in 1982, the difficulty of manufacturing micron-scale interelectrode gaps is further supported when Fitzpatrick teaches in U.S. Patent 4,667,126 that "*maintenance of such*

small spacings [i.e., less than 10 microns] with high temperatures and heat fluxes ***is a difficult if not impossible*** *technical challenge."* (See Fitzpatrick, Col. 2, lines 6-17).

Therefore, since *Rason* **does not teach every limitation** of claim **1**, then the rejection under USC 102(b) is improper and should be withdrawn. Accordingly, claim **1** is now in condition for allowance.

Claims **5-11, 22, and 25-29**

Claims **5-11**, **22**, and **25-29** depend from claim **1**. As presented above, applicants submit that claim **1** is in condition for allowance. All claims depending from and further limiting an allowable claim are, themselves, allowable. *See* MPEP 2141.03. Therefore, claims **5-11**, **22**, and **25-29** are now in condition for allowance.

Specifically regarding claim **7**, *Rason* does not teach the use of **barium** vapors.

Independent claim **30**

Claim **30** recites a method of converting heat using thermionic electron emission, using a **micron-spaced** interelectrode gap. As discussed above, *Rason* does not teach a **micron-spaced** interelectrode gap. Therefore, since *Rason* does not teach every limitation of claim **30**, then the rejection under USC 102(b) is improper and should be withdrawn. Accordingly, claim **30** is now in condition for allowance.

Claims **31-34**

Claims **31-34** depend from claim **30**. As presented above, applicants submit that claim **30** is in condition for allowance. All claims depending from and further limiting an allowable claim are, themselves, allowable. *See* MPEP 2141.03. Therefore, claims **31-34** are now in condition for allowance.

103 Rejections

Rejection of Claims **2-4** and **12-21** under 35 U.S.C. § 103

The Office rejected claims **2-4** and **12-21** under 35 U.S.C. 103 as being unpatentable over Rason et al. (US 3,843,896). Applicants respectfully traverse.

Claims **2-4**

Claims **2-4** recite, inter alia, an interelectrode gap less than 10 microns; in-between 1 and 10 microns; and in-between 1 and 3 microns, respectfully, which the Office admits are not specifically taught by *Rason* et al. The Office then asserts that it would have been obvious to change the large interelectrode gaps taught by *Rason* (see Col. 6, lines 2-8, and Table D) to the small gaps claimed in the present invention, since such a change would be within the level of ordinary skill in the art. However, at the time when *Rason's* application was filed in 1972 (some 30 years ago), reliable, reproducible, and cost-effective techniques for manufacturing micron-sized interelectrode gaps simply did not exist. It has only been in the past 10-15 years that the necessary semiconductor fabrication techniques, such as MEMS surface micromachining, have been developed and successfully used. Applicants respectfully request that the Office provide some evidence that reliable, reproducible, and cost-effective techniques for manufacturing micron-sized interelectrode gaps existed in 1972.

Since it is not obvious that a person of ordinary skill in the art could have selected the size ranges recited in claims **2-4**, then the rejection under 35 USC 103 is improper and should be withdrawn. Accordingly, claims **2-4** are now in condition for allowance.

Also, since claims **2-4** depend from claim **1**, which was previously argued to be in condition for allowance, then claims **2-4** should be allowable, independent of any 103 rejections.

Claims **12-15**

Claims **12-15** recite, inter alia, various materials and combinations of materials that are used for the thermionic emissive materials of the present invention. The Office asserts that these materials were well known to persons of ordinary skill in the art. Applicants respectfully traverse, and request that the Office provide evidence of such assertion. In fact, the recently issued, commonly-assigned related patents to King et al., that teach these novel materials for use in microminiature thermionic converters (i.e., 6509669, 6407477, 6563256, 6411007, and 6294858, which were all incorporated by reference), provide evidence that such materials were

not well-known to persons of ordinary skill in the art at the time the invention was made. Hence, the rejection of claims **12-15** under 35 USC 103 is improper and should be withdrawn. Accordingly, claims **12-15** are now in condition for allowance.

Also, since claims **12-15** depend from claim **1**, which was previously argued to be in condition for allowance, then claims **12-15** should be allowable, independent of any 103 rejections.

Claims **16-18**

Claims **16-18** depend from claim **1**. As presented above, applicants submit that claim **1** is in condition for allowance. All claims depending from and further limiting an allowable claim are, themselves, allowable. *See* MPEP 2141.03. Therefore, claims **16-18** are now in condition for allowance.

Claims **19-21**

Claims **19-21** recite a length of the emitter electrode as being less than 200 microns; in-between 50 and 200 microns; and in-between 50 and 100 microns, respectfully. The Office asserts that the dimensions of *Rason's* emitter electrode are unknown. Applicants respectfully traverse.

Rason teaches emitter electrode diameters, **D**, ranging from 0.11 cm [1100 microns] to 2.35 cm (See *Rason*, Table C). Also, *Rason* teaches D = 1.78 to 1.93 cm (see *Rason*, Table D). These dimensions are **very much greater** than those recited in claims **19-21**, again, for the reason stated above that MEMS-type micromachining techniques simply did not exist when Rason's application was filed. Hence, such a large change in size (i.e., reduction) would **not** be generally recognized as being within the level of ordinary skill in the art. Hence, the rejection of claims **12-15** under 35 USC 103 is improper and should be withdrawn.

Additionally, claims **19-21** depend from claim **1**. As presented above, applicants submit that claim 1 is in condition for allowance. All claims depending from and further limiting an allowable claim are, themselves, allowable. *See* MPEP 2141.03. Therefore, claims **19-21** are now in condition for allowance.

New Claim 56

Applicants have submitted new independent claim **56**, which is a combination of claims **1**, **4**, **5**, and **21**. No new matter has been added, and no new search should be required. Support for new claim **56** can be found in Applicant's Specification at p. 5, lines 3-6 and at p. 6, lines 7-9.

Since new claim **56** includes all of the limitations of claim **1**, and since claim **1** is now in condition for allowance, it follows that new claim **56** is also in a condition for allowance.

CONCLUSION

Applicants have responded to each and every objection and rejection, and urge that claims **1-22, 24-34,** amended claims **23** and **24**, and new claim **56** as presented are now in condition for allowance. Applicants request expeditious processing to issuance.

The Office is authorized to charge **Deposit Account # 19-0131** for any necessary fees regarding this response, in particular, for 3 new independent claims, and for a 1-month extension of time to file a reply to the Office Action.

Respectfully submitted,

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